# SUMMIT OZONESONDES


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7/20/2016

IASOA ozone working group

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# OUTLINE

1) Data processing

   Addition of upper atmospheric ozone using Standard atmosphere

2) Ozone at Summit Station

   11-year time series

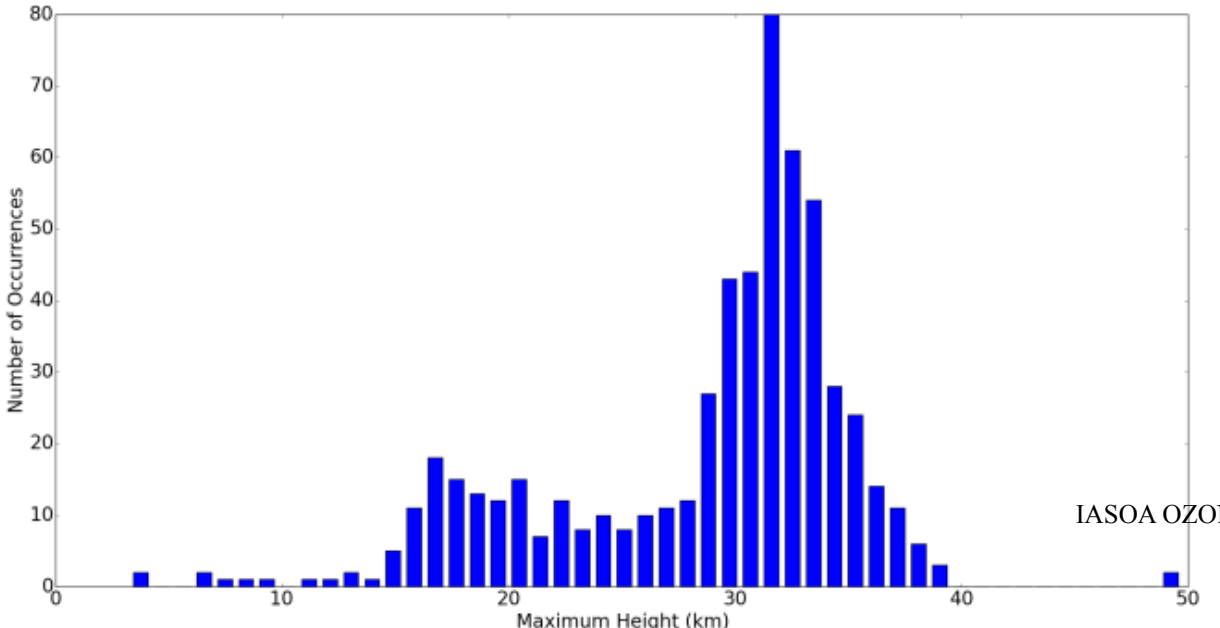
   Trends?

3) Comparison with other nearby Arctic locations

   Ny-Alesund and Kiruna

# INTRODUCTION

- **Ozone is important for atmospheric and surface chemistry in the Arctic**
- **Will be used as a priori data for ozone retrievals from infrared spectra**
- **Data are downloaded from archive of the ESRL Global Monitoring Division: http://www.esrl.noaa.gov/gmd/dv/data/index.php?site=SUM&category=Ozone&type=Balloon**
- **Ozonesonde height limit**
  - Lack of data in the upper stratosphere
  - The necessity of climatology data to estimate total ozone column of atmosphere
  - Essential for ozone trend analysis and change detection



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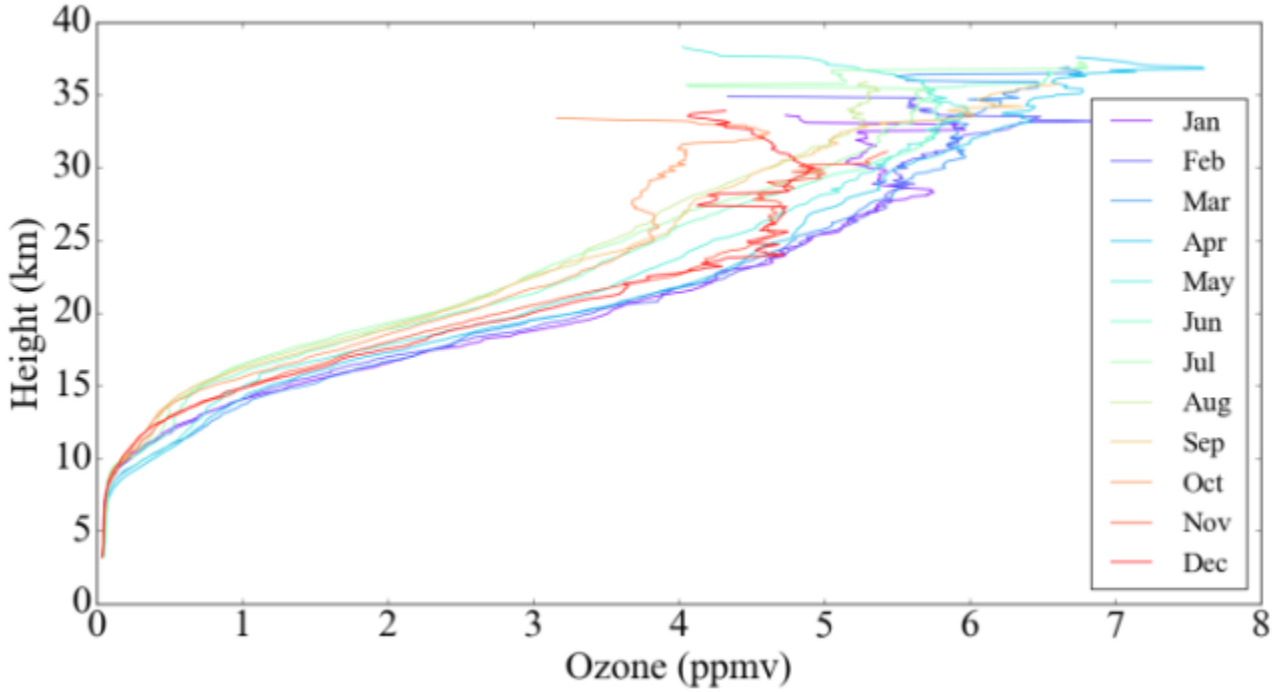
# Average Ozone concentration (ppmv)

- monthly mean ozone profile During 2005-2016



# DOBSON UNIT

- Thickness of gas in unit of 10 μm at STP

$$\text{Total column ozone in DU} = \sum_{i=0}^{n} \frac{VMR_i * 10^{-6} * P_i}{Rd * T_i * V0 * MWair} * dh_i$$

Rd = 287 (pa*m3/(k*kg))

MWair = 28.9644 (g/mol)=28.9644 *10**-3 (kg/mol)

Vo = 22.4136 $*10^{-3}$(m3/mol);

- P, T, and VMR are pressure in pa, temperature in Kelvin, volume-mixing ratio in ppm for each layer. Also $dh_i$ is each layer height in 10 μ.

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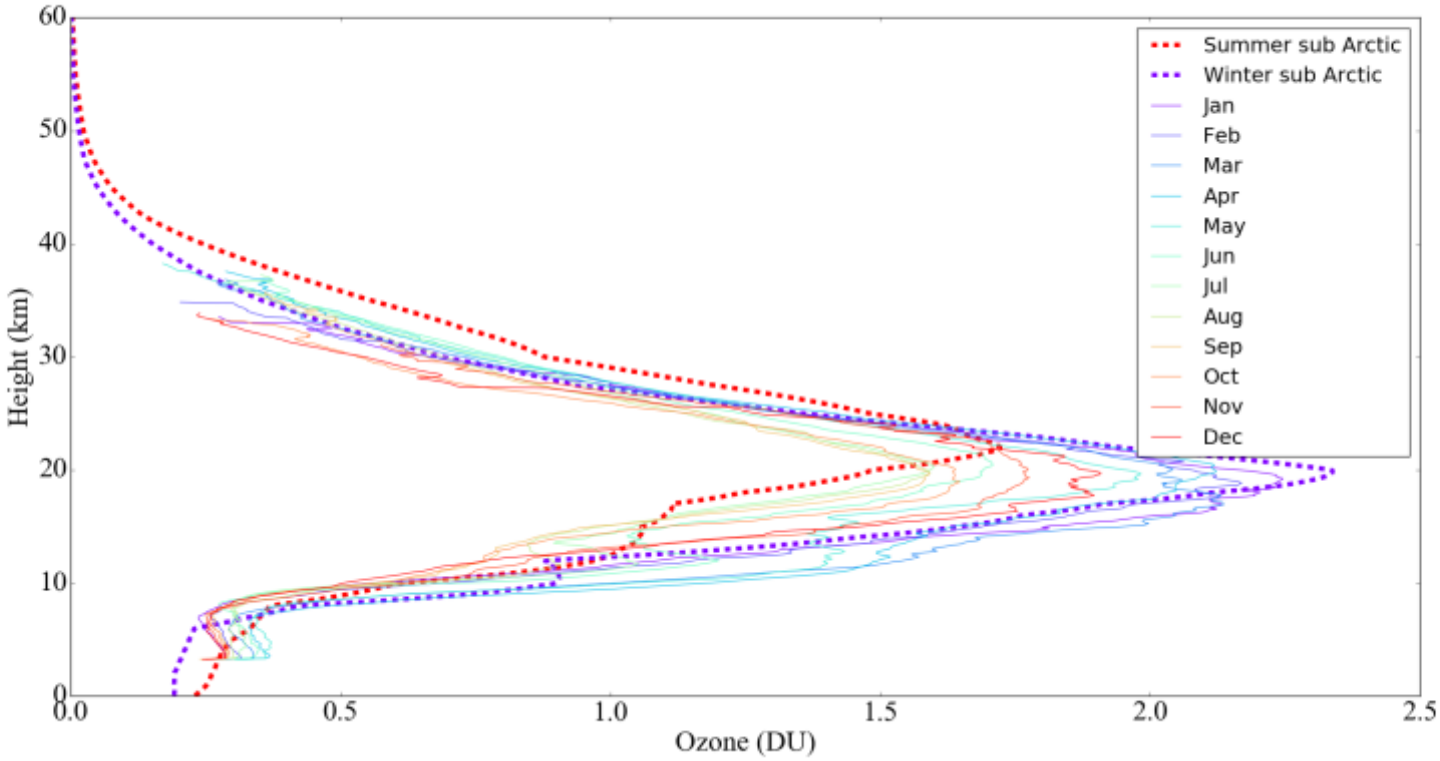
# Climatology Ozone Profile (DU)

- **100 m layers ozone column profile**
- **Monthly average**
- **Subarctic ozone profile**



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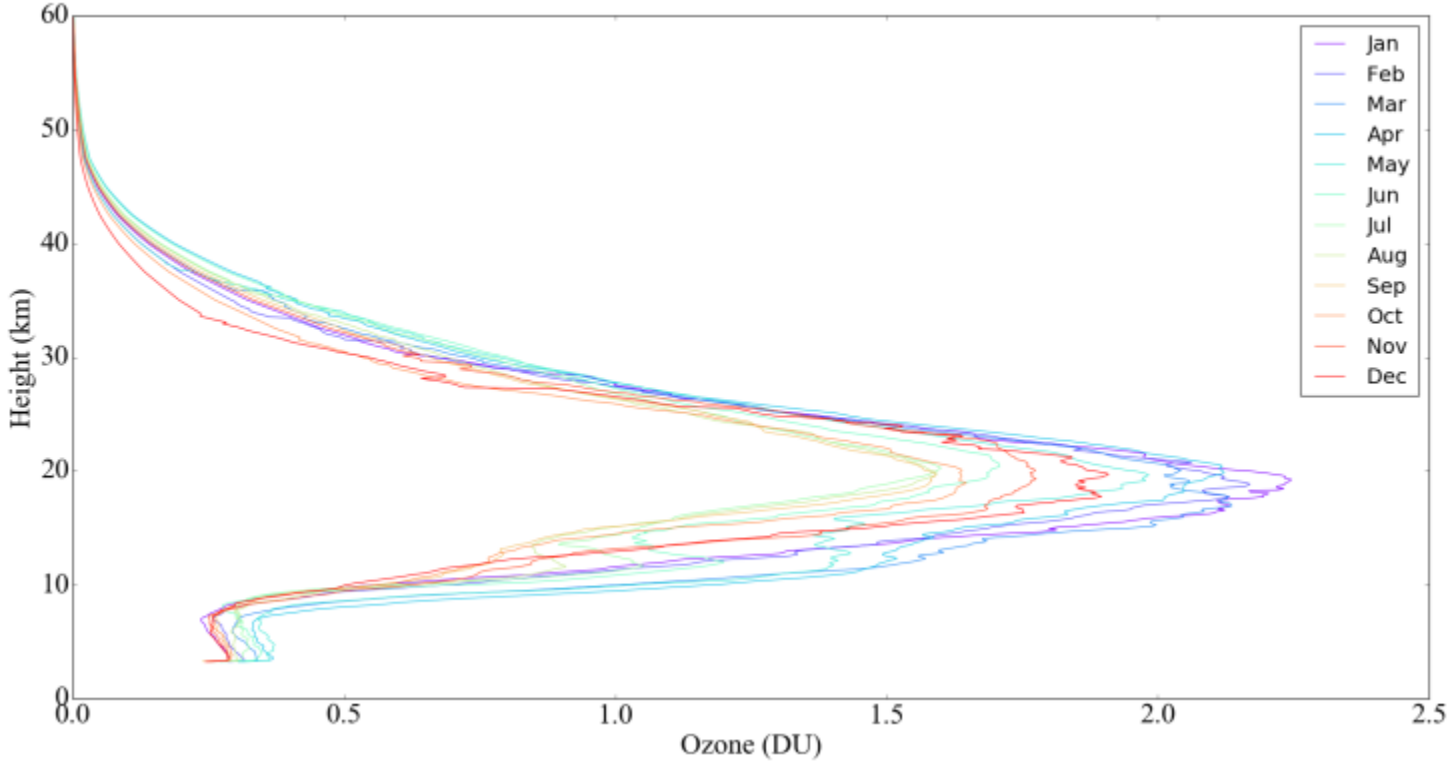
# Climatology Ozone Profile (DU)

- **Having monthly climatology based on high monthly variation**
- **Using winter time subarctic for upper stratosphere**
- **Scaling subarctic upper stratosphere to match each month mean ozone profile**



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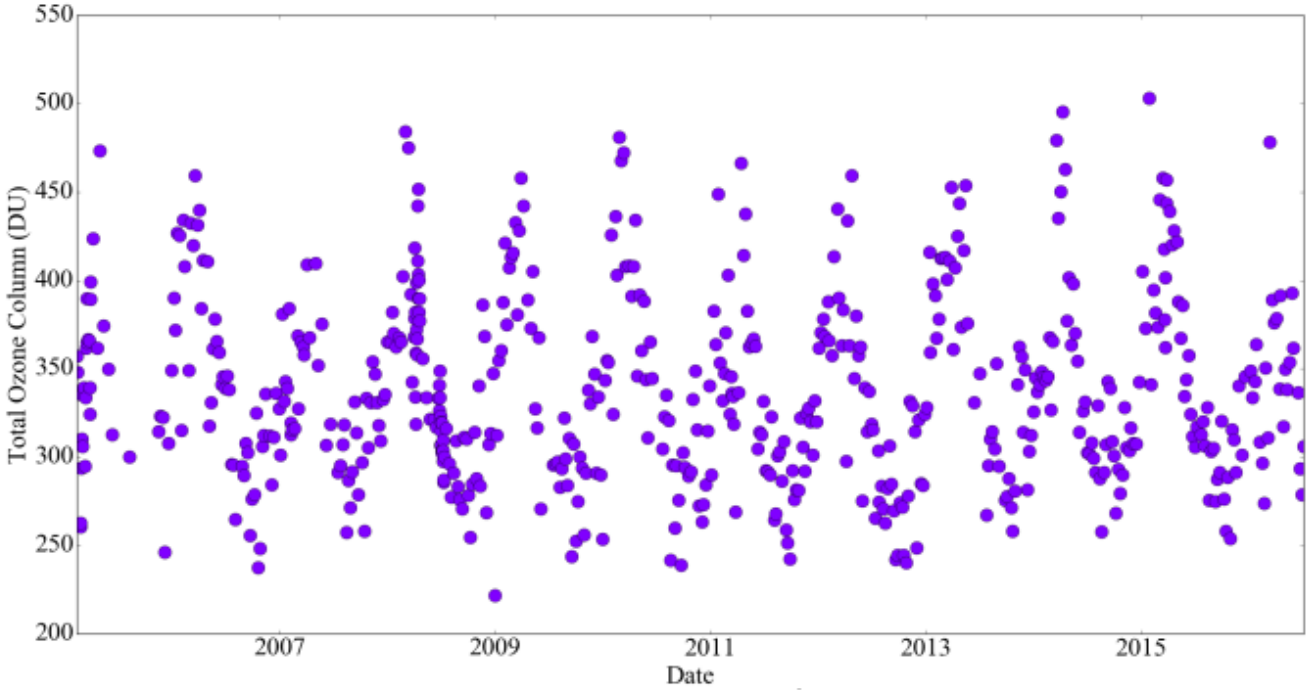
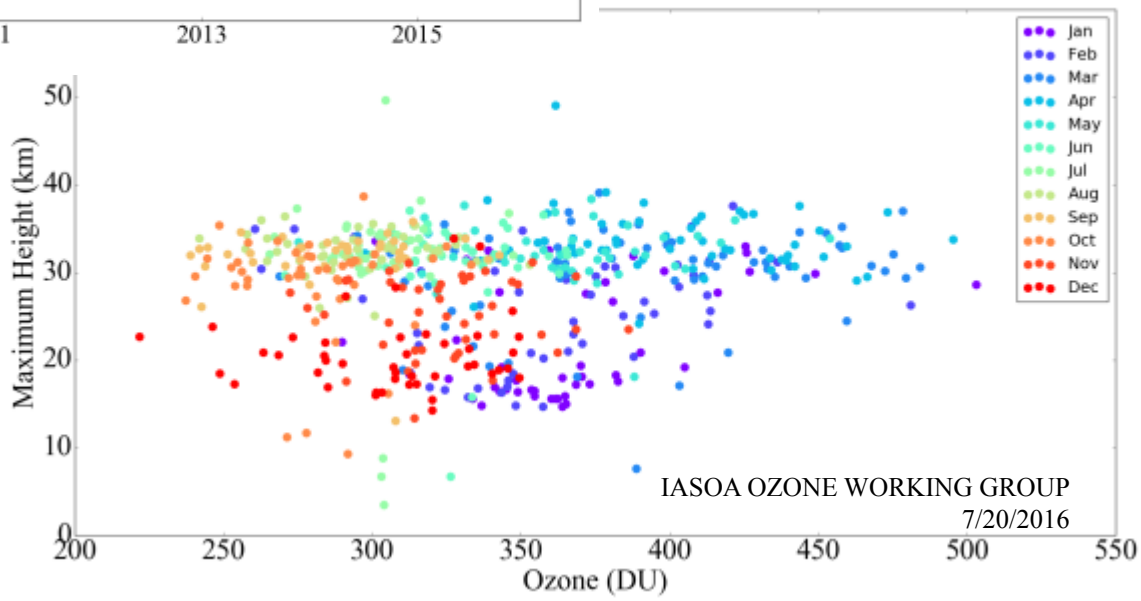
# Time Series and Scatter Plot During 2005-2016

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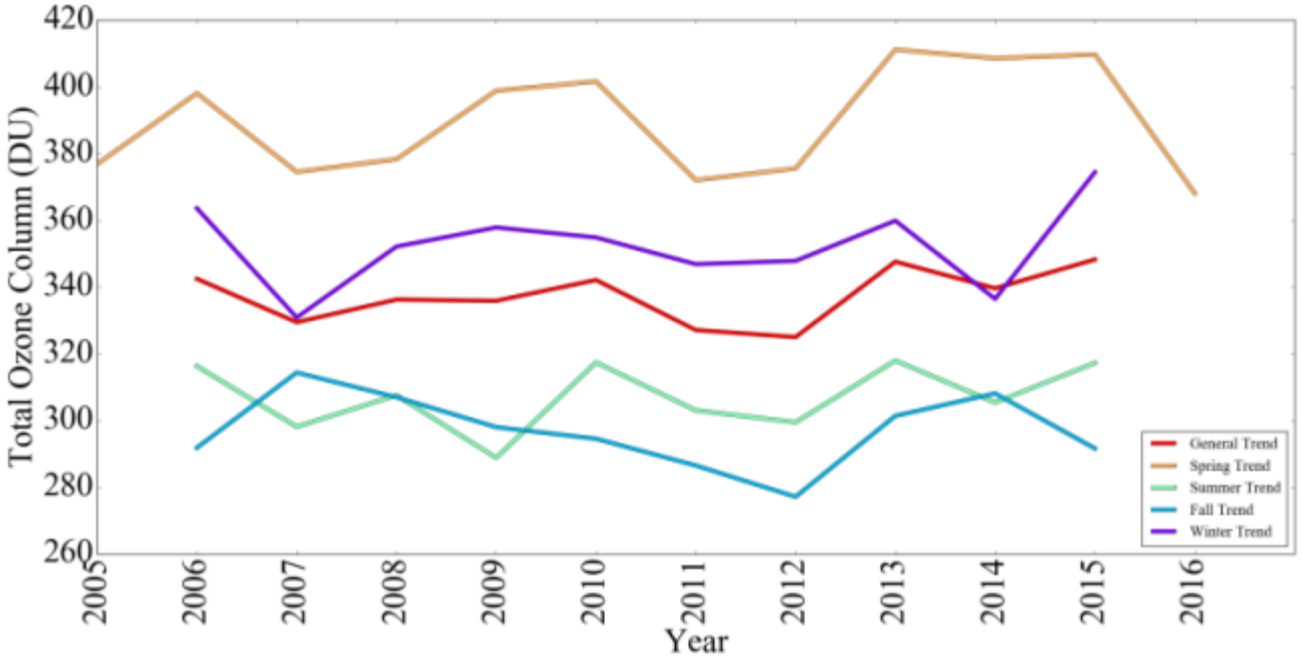
# Trends?



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# ATMOSPHERIC LAYERS

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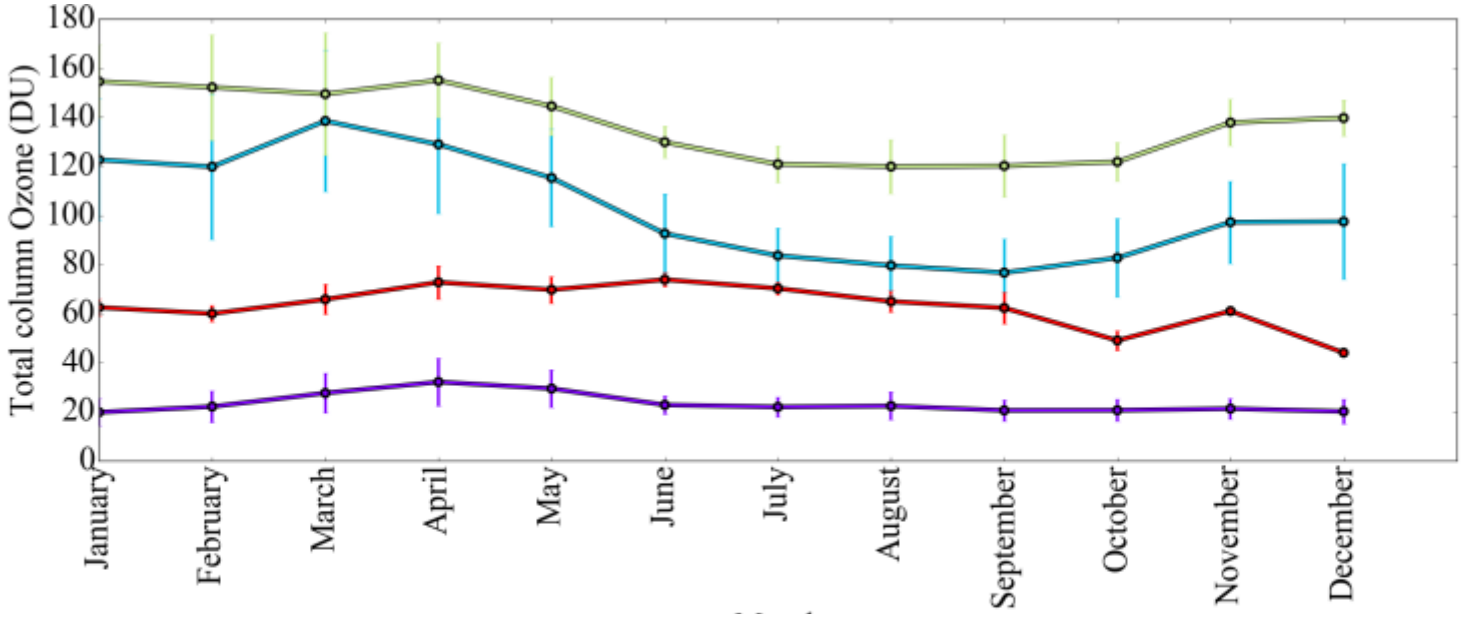
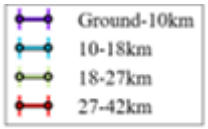
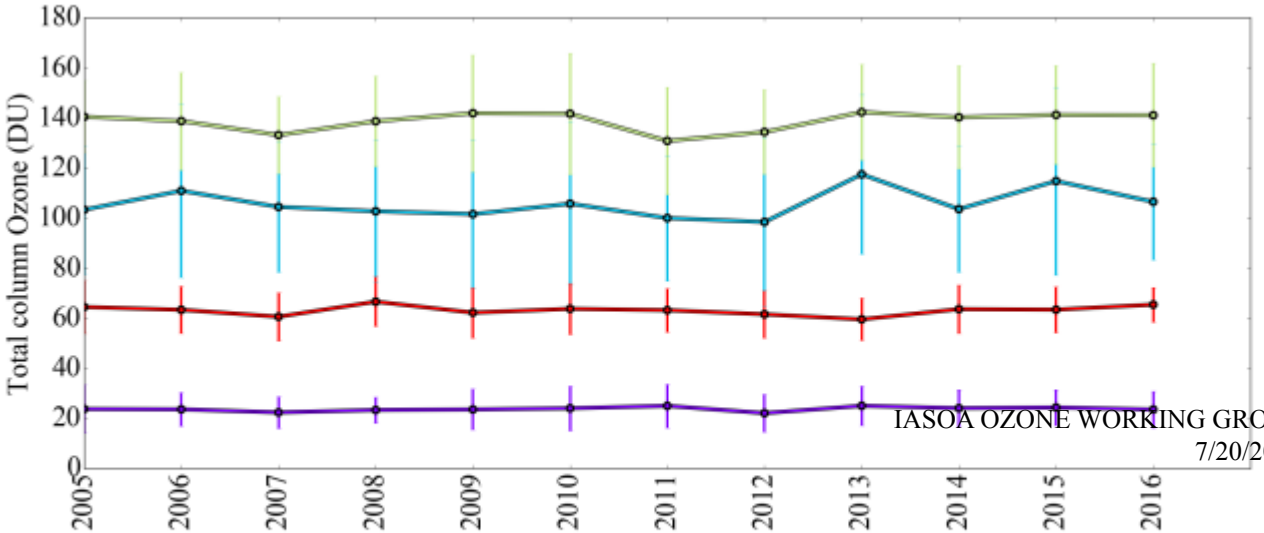
# Atmospheric Layers



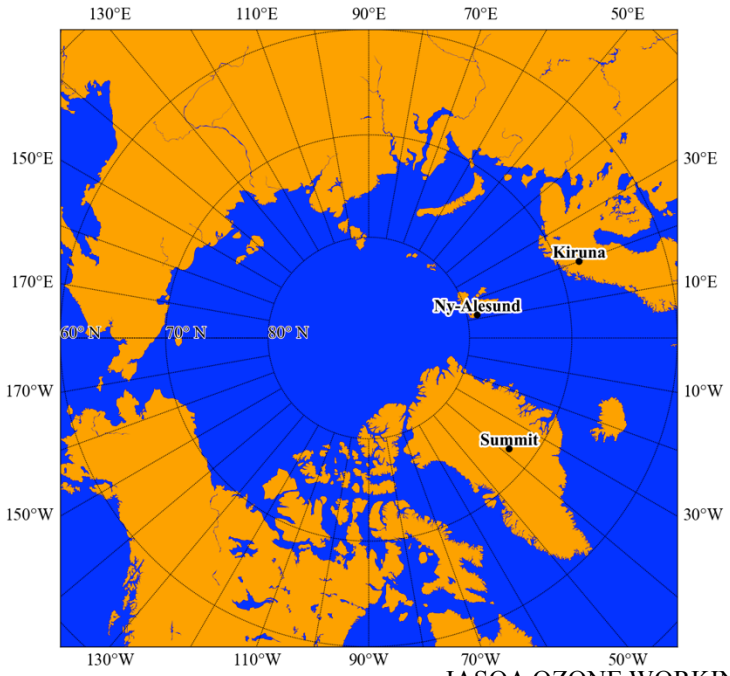



# Comparison

- Vigouroux, C. et al., 2008.

"Evaluation of tropospheric and stratospheric ozone trends over Western Europe from ground-based FTIR network observations". *Atmospheric Chemistry and Physics*, 8(23), pp.6865–6886.

- Kiruna
- Ny Alesund



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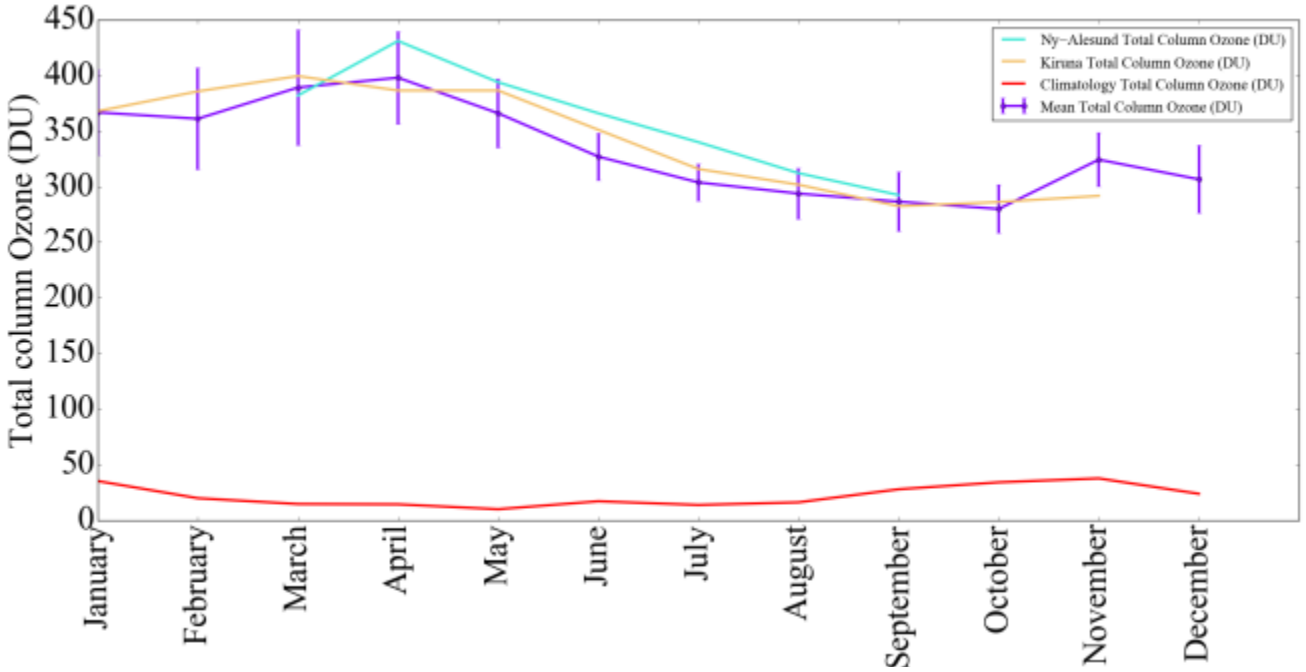
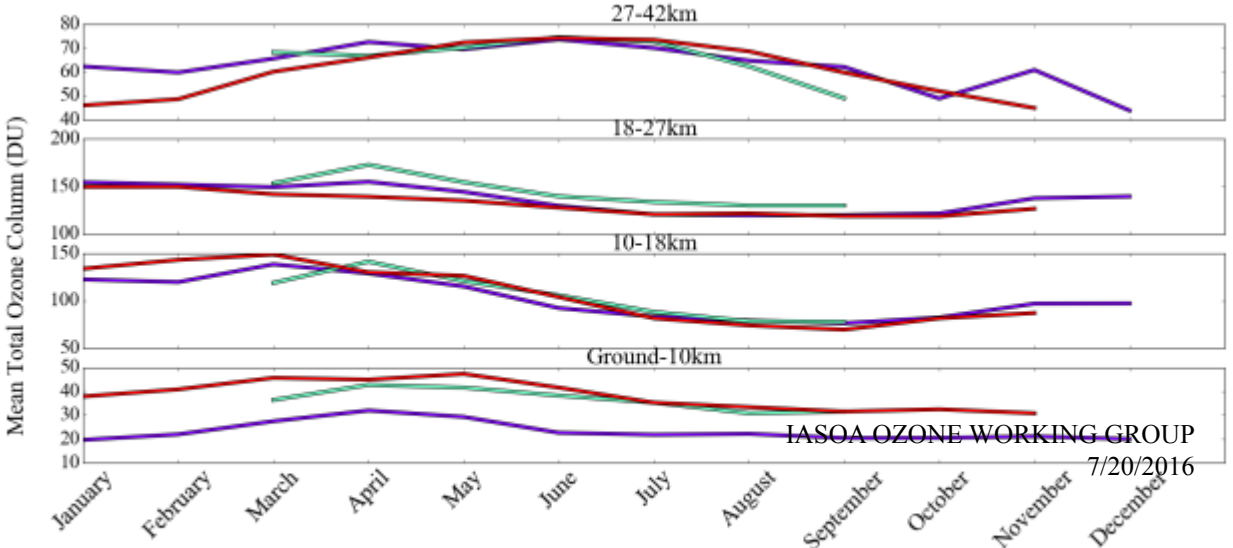
# Comparison

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# THANKS FOR YOUR ATTENTION

# Questions
# Suggestions